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Filling the gaps: first record of the Crown-of-thorns Starfish, *Acanthaster planci* (Linnaeus, 1758) (Spinulosida: Acanthasteridae), at Gorgona Island, Colombia, Tropical Eastern Pacific

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Abstract. We report the occurrence of a major corallivore, the Crown-of-thorns Starfish *Acanthaster planci*, on the coral reefs of Gorgona Island, Tropical Eastern Pacific. Three individuals were sighted on opposite sides of the island, where they fed on small coral colonies of *Pavona varians* and *Pocillopora damicornis*. These sightings are noteworthy in light of reports that have demonstrated that the geographic distribution of *A. planci* is gradually increasing in the equatorial eastern Pacific, particularly south of the Gulf of Chiriquí (Panama) where it was previously absent.

Key words. Coral reefs; corallivores; echinoderms; range extension; starfish

The Crown-of-thorns Starfish, *Acanthaster planci* (Linnaeus, 1758), is one of the most voracious and important corallivores of the tropical Indo-Pacific Ocean (Glynn & Enochs 2011). In moderate densities, they are capable of modifying the structure of the coral community (Pratchett 2007). During outbreaks, they can consume up to 95% of the live coral cover existing at a given site (Birkeland 1987). Within the Tropical Eastern Pacific, *A. planci* has been reported in Mexico (Gulf of California, Revillagigedo Islands), Clipperton Atoll, Costa Rica (Cocos Island, Isla del Caño and mainland), Panama (Gulf of Chiriquí) and Ecuador (northern Galapagos Islands; Porter 1972; Glynn 1974; Bakus 1975; Guzmán 1988; Glynn et al. 1996; Hickman 1998; Figure 1). Colombia is the latest country in the Tropical Eastern Pacific to document the presence of *A. planci*. Individuals have been sighted consistently on the coral formations of the oceanic Malpelo Island since 2004 (Narváez & Zapata 2010). A photograph from the mid-1980s (by J.R. Cantera, pers. comm.) suggested the presence of this species at Gorgona Island's southernmost rocky outcrop (El Viudo), but this record remained unknown until recently (Neira & Cantera 2005; Narváez & Zapata 2010). Here, we report the first documented occurrence of *A. planci* on the coral formations of Gorgona Island, a continental island off the coast of Colombia, based on three observed individuals.

Visual observations were made while snorkeling or diving on two coral communities of Gorgona Island (02°58′27″ N, 078°11′13″ W), Colombia, in the Tropical Eastern Pacific (TEP) (Figure 1). La Azufrada coral reef covers approximately 11.8 ha on the eastern (leeward) side of the island and is dominated by branching colonies of the genus *Pocillopora* (Díaz et al. 2000; Zapata & Vargas-Angel 2003). La Azufrada coral reef has been extensively studied since the mid-1970s (Prahl et al. 1979; Glynn et al. 1982) and has been the site of a long-term monitoring study since 1998 (Garzón-Ferreira & Rodríguez-Ramírez 2010; Zapata et al. 2010). The coral community of La Camaronera, 8 ha in size, is located on the southwestern (windward) shelf of the island and is dominated by massive colonies of the genera *Pavona*, *Gardineroseris* and *Porites* (Palacios & Zapata 2014). La Camaronera was explored extensively by teams of 4 or 5 divers in 2010 and 2011.

Species identification was based on morphological diagnostic features for *Acanthaster* in the TEP (Glynn 1974). For each observation of *A. planci*, an assessment of morphology (size, number and length of arms), behavior (activity pattern, coral species being consumed), and location (reef zone, position on the reef) were recorded. The specimens were not manipulated or collected for lack of permits from park authorities. Sightings of the starfish at La Camaronera and La Azufrada occurred while conducting research under permit PIBD-DTSO 011-10 granted by Parques Nacional Naturales de Colombia and agreement No. 010-12 between MRM and the Marine and Coastal Research Institute of Colombia, INVEMAR.

The first individual of *A. planci* observed was an adult with a total diameter of 50 cm bearing 15 arms, each 7.5 cm long, radiating from a central disc 35 cm in diameter (Figure 2a). On the aboral surface, the specimen had sharp thorns 0.7–2.5 cm in length and a bull's-eye-like color pattern consisting of four alternating white and red bands. This individual was observed twice, on 27 November 2010 and 26 February 2011, on the outer

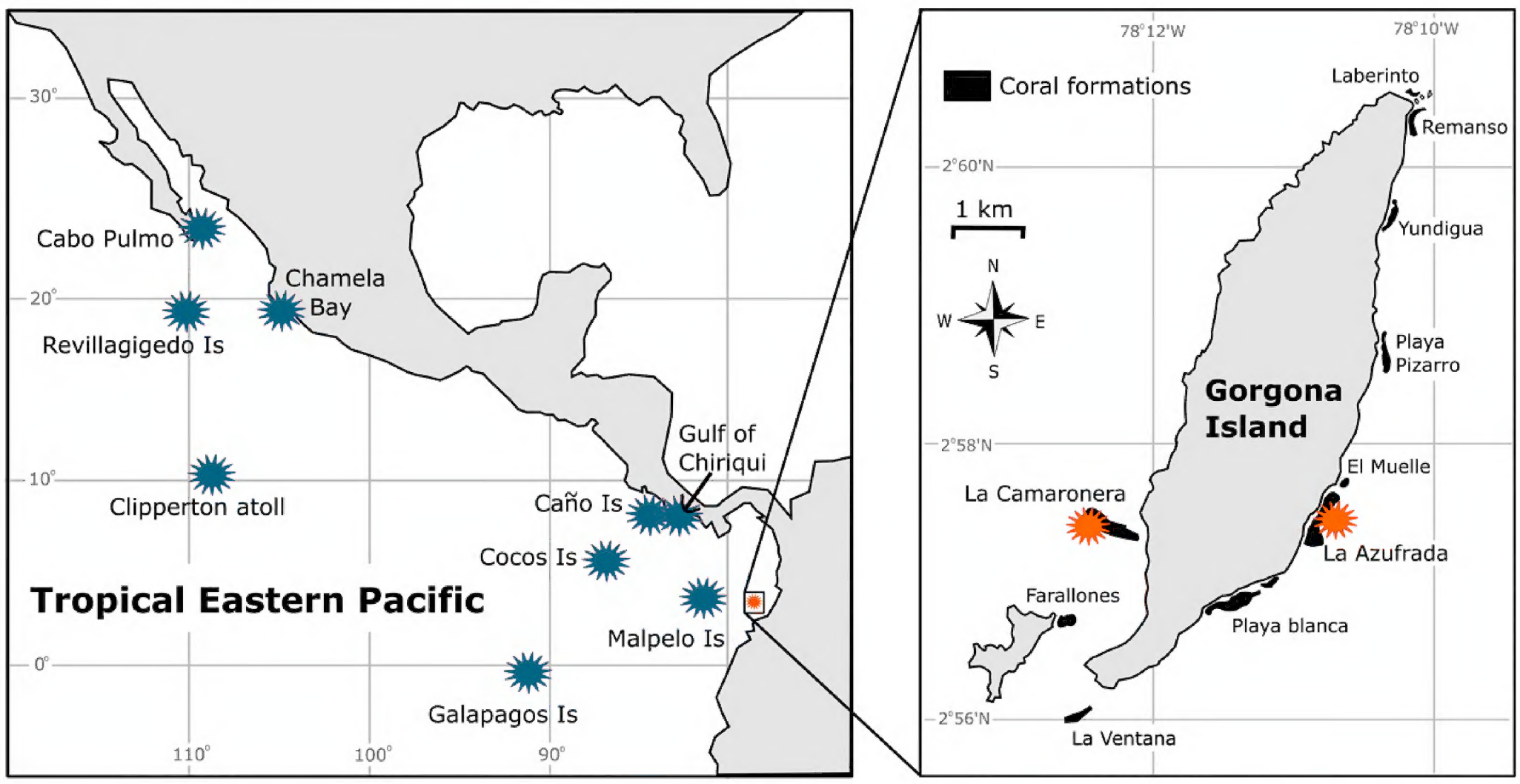

Figure 1. Geographical distribution of *Acanthaster planci* (Linnaeus, 1758) in the Tropical Eastern Pacific, showing previously known (blue stars) and new records (orange stars).

edge of La Camaronera reef during daytime dives. Despite a 3-month period between sightings, this starfish was observed < 30 m from the location of its initial sighting. In both instances, the starfish had its stomach everted and was feeding on small colonies (< 15 cm in diameter) of the hard coral *Pavona varians* (Verrill, 1864) (Figure 2b). Dead colonies in its immediate vicinity suggested that the coral had recently been consumed by this individual starfish.

Two other individuals of *A. planci* were sighted on three occasions at La Azufrada reef. One individual was a subadult measuring 19 cm in diameter, with a disc diameter of 10 cm. It had a homogeneous bright red coloration and 15 arms, each 4.5 cm long. The thorns were 0.5–1.5 cm long. The first sighting occurred during daytime on 19 July 2013 when the starfish was inactive on the reef slope, concealed within a crevice, and covered with coral rubble (Figure 3a). During a night dive on 4 November 2013, the same starfish was sighted again < 30 m from its initial location on the reef slope, actively feeding on a small colony (< 25 cm in diameter) of the branching coral *Pocillopora damicornis* (Linnaeus, 1758) (Figure 3b). Another individual was sighted on 22 November 2013. This starfish was found between the reef slope and the reef flat of La Azufrada reef but no detailed observations were made (K. Mejía-Quintero, pers. comm.).

This is the first formal record of *Acanthaster planci* at Gorgona Island, Colombia. It extends the geographical distribution of this species ca. 400 km east of Malpelo Isand (Narváez & Zapata 2010) and represents the easternmost record of *A. planci* within the Tropical Eastern Pacific (078°11′13″ W; Figure 1).

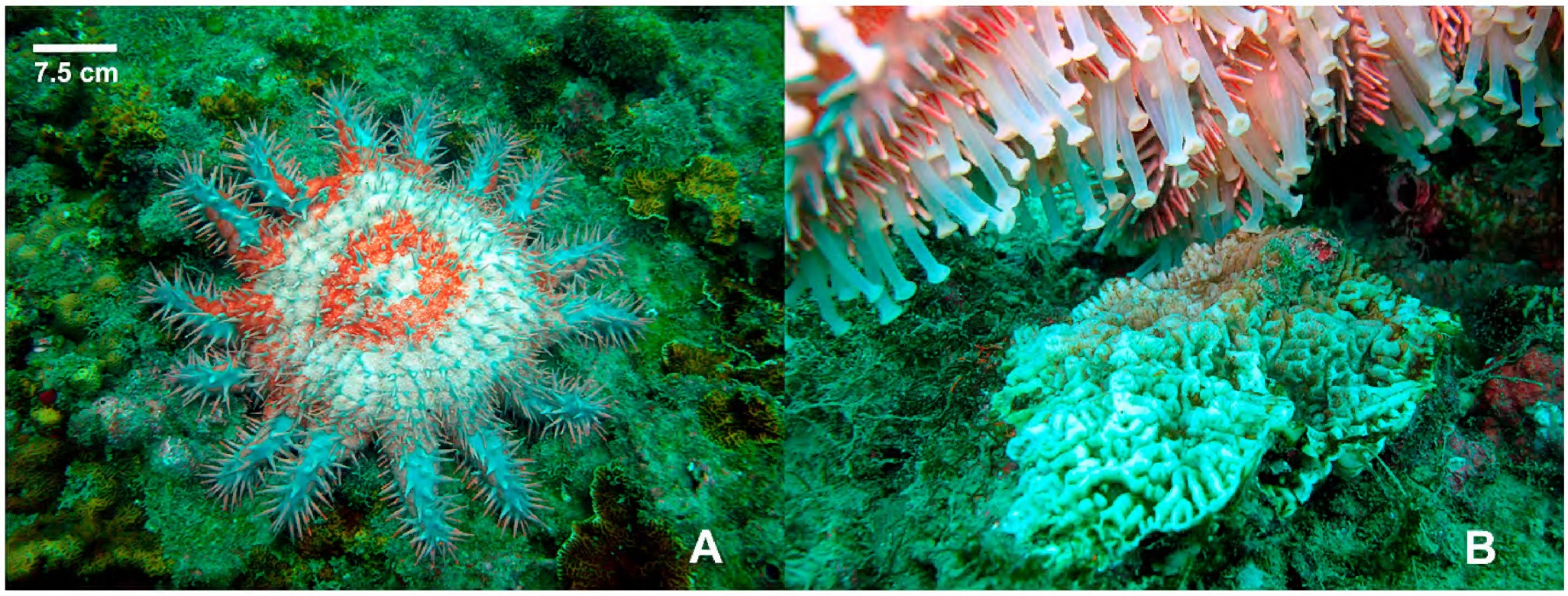

Figure 2. Adult of *Acanthaster planci* (Linnaeus, 1758) observed at La Camaronera reef, Gorgona Island: (**A**) aboral view; (**B**) soft tissue of a colony of *Pavona varians* consumed by *A. planci*. Photographs by D. Lozano-Cortés.

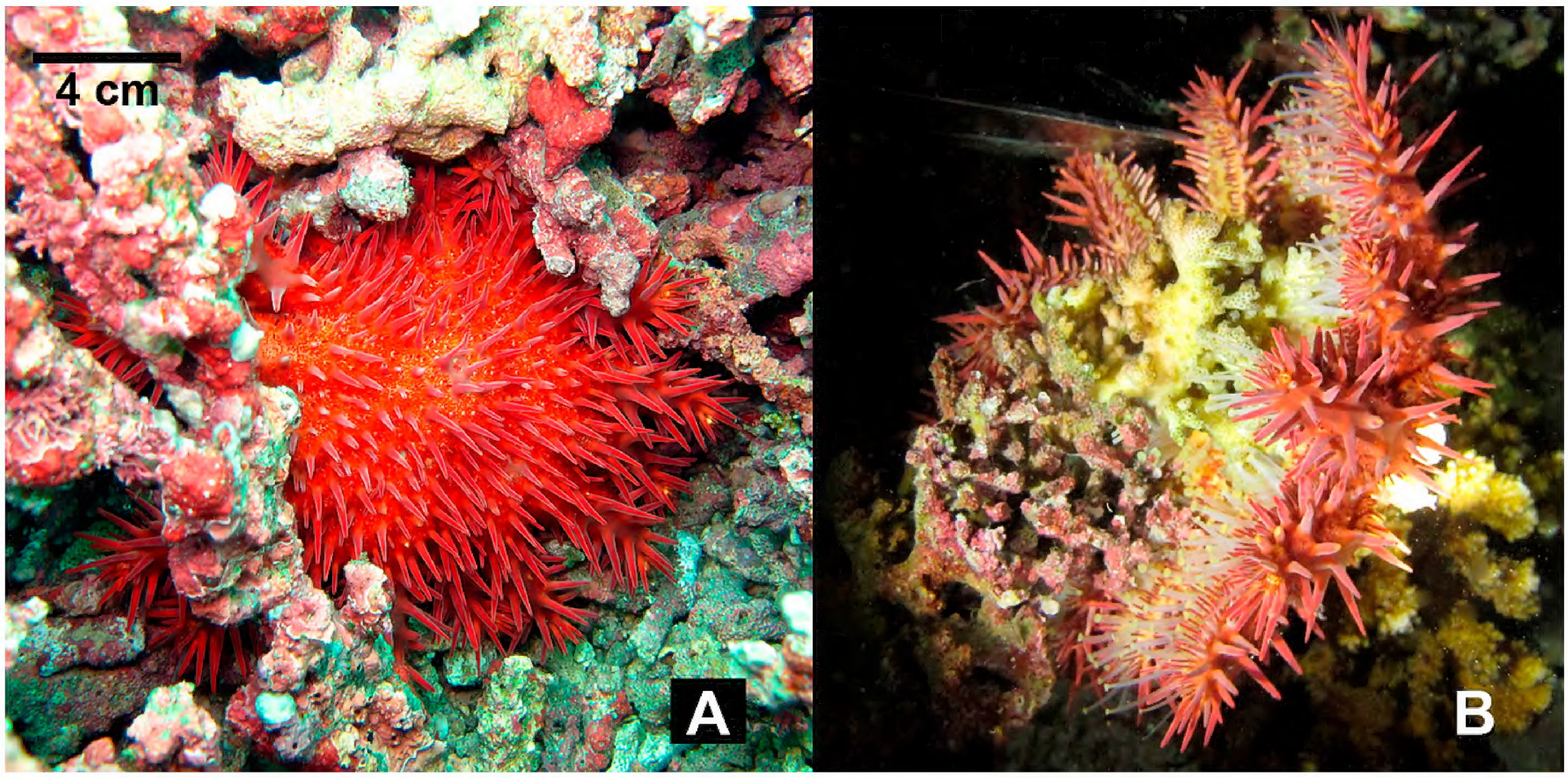

Figure 3. Subadult individual of *Acanthaster planci* (Linnaeus, 1758) observed at La Azufrada coral reef, Gorgona Island: (**A**) aboral view, starfish hiding among coral rubble; (**B**) feeding at night on the branching coral *Pocillopora damicornis*. Photographs by MRM.

In their description of the coral reefs of Gorgona Island, Glynn et al. (1982) highlighted the absence of *A. planci* and suggested that low temperatures and salinities in the Gulf of Panama, due to seasonal upwelling, could limit larval dispersal south of the Gulf of Chiriquí, Panama. However, recent reports of *A. planci* from the Galapagos Islands (Hickman 1998), Malpelo Island (Narváez & Zapata 2010), and now Gorgona Island suggest that this species is slowly increasing its geographic distribution in the TEP. Other than the photographic record of *A. planci* from the southernmost rocky outcrop of Gorgona Island in the mid-1980s (Neira & Cantera 2005), all evidence suggests that the arrival of *A. planci* on Gorgona Island occurred recently.

The moderate numbers usually reported for *A. planci* in the TEP (< 40 individuals/ha; Maté 2003; Reyes-Bonilla 2003) and the low numbers observed at Galapagos, Malpelo, and Gorgona Islands suggest that the presence of this starfish in the Equatorial Eastern Pacific should not be a cause for concern. It is important, however, that conservation authorities educate divers about *A. planci* so they may contribute to monitoring its abundance within the coral reefs of the region.

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